Supplementary Material

When the concept of the default mode of brain function was introduced (Raichle, et al, 2001), decreases in brain activity were observed relative to specific attention-demanding visual tasks (Shulman et al., 1997) that were broadly defined as "goal-directed". Subsequent interpretations have asserted that the default network is deactivated by, uninvolved in, or even antithetical to, goal-directed behavior. Below are specific examples from the cognitive neuroscience literature of these assertions (italics added):

> "Defining the baseline state of an area in this manner attaches meaning to a group of areas that consistently exhibit decreases from this baseline, during a wide variety of goal-directed behaviors monitored with positron-emission tomography and functional MRI. These decreases suggest the existence of an organized, baseline default mode of brain function that is suspended during specific *goal-directed* behaviors."
> Raichle et al., p. 676, *PNAS,* 2001

> "Of particular interest here is the so called 'default mode network' (DMN), a network of regions that show high metabolic activity and blood flow during rest but which deactivate during *goal-directed* cognition."
> Carhart-Harris and Friston, p. 1267, *Brain*, 2010

> "Recent work has linked these disorders to abnormalities in a "default mode" network, comprising brain regions routinely deactivated during *goal-directed* cognitive tasks."
> Kelly et al., p. 527, *NeuroImage*, 2008

> "The default network is a system of brain areas that are engaged when the mind is not involved in *goal-directed* activity…
> "Default activity does not represent a state of "no cognitive activity," but rather is characteristic of thought that is not *goal-directed* and may involve day dreaming, self-referential processing, or the simulation of future events."
> Park et al., p. 1, *Frontiers in Human Neuroscience*, 2010

> "Furthermore, consideration must be given to the default mode network of brain structures that have been shown to consistently decrease during *goal directed* behaviors and thus may subserve resting state brain functions."
> Shipman & Astur, p. 438, *Behavioural Brain Research*, 2008

> "Recent findings have emphasized that the default state of the brain, i.e., the resting state, is far from being inactive and quiescent, but rather involves a network of active nodes that are systematically inactivated in *goal-directed* behavior."
> Sigman et al., p. 832, *Neuron*, 2005

> "One such network, termed the 'default-mode' network is particularly observable during resting states, and its activation is conjectured to be incompatible with *goal-directed* activity…
> "The task-negative elements of the network have been associated with an introspective attentional orientation related to mentalising and emotional processing and the maintenance of a sense of self. These elements can be classified as 'stimulus-independent thoughts' and in as much as they are more or

> less incompatible with *goal-directed* activity, represent a potential source of cognitive task interference."
> Sonuga-Barke & Castellanos, pp. 978-979, *Neuroscience and Biobehavioral Reviews*, 2007
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> "Considered collectively, the present data support the existence of an organized mode of brain function in children ages 7-12 that is present as a baseline or default state and is attenuated parametrically during *goal-directed* tasks."
> Thomason et al., p. 1500, *NeuroImage*, 2008
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> "This network corresponds to the so-called 'default' network, which is commonly deactivated during *goal-directed* behavior and suppressed during difficult perceptual or attentional demanding tasks."
> Tosoni et al., p. 1452, *Nature Neuroscience*, 2008

Supplemental Movie 1: Brain activity over 25 seconds associated with autobiographical planning. Brain activity associated with each TR for planning is presented in a real time video with intermediate intervals animated with Adobe After Effects CS3. Regions in dark blue are from latent variable one. Regions in green are from with latent variable two. Regions in light blue are overlapping. Mean brain scores convey changes in brain activity related to the autobiographical planning task at each 2.5 s TR.

Supplemental Movie 2: Brain activity over 25 seconds associated with visuospatial planning. Regions in red are from latent variable one. Regions in green are from with latent variable two. Regions in yellow are overlapping. Mean brain scores convey changes in brain activity related to the Tower of London task at each 2.5 s TR.

Supplemental Figure 1: Tower of London behavioral results by number of moves to reach a solution.

Supplemental Figure 2: Activity associated with counting relative to planning from latent variable two. The counting condition covaried with the Tower of London condition on the first latent variable, indicating that counting engages the dorsal attention network, though to a lesser extent (See Fig. 1B & 1C). Relative to planning, counting also engaged an additional set of regions depicted here. The pattern of activity is consistent with previous findings [Ortuno F, Ojeda N, Arbizu J, Lopez P, Marti-Climent JM, Penuelas I, & Cervera S (2002). Sustained attention in a counting task: Normal performance and functional neuroanatomy *NeuroImage* 17, 411-420]. In the counting condition, relative to both planning tasks, participants made early button press responses more frequently, which may account for the observed activity in motor cortex. Activation peaks are listed in Supplemental Table 1.

Supplemental Figure 3: Overlap of task-related activity and intrinsically defined resting-state networks. (A) Autobiographical planning and the default network, B) visuospatial planning and the dorsal attention network, and C) conjunction of both planning tasks and the frontoparietal control network. Red = task-related activity; Green = resting-state network; Yellow = overlap.

Supplemental Figure 4: Frontoparietal control network coupling relative to trial onset at fixation. The frontoparietal control network is reliably coupled with the default network during autobiographical planning, but not during visuospatial planning, suggesting modulation of network coupling according to task demands.

The dorsal attention network is coupled with the frontoparietal control network for visuospatial planning as well as autobiographical planning. Network coupling between the dorsal attention network and the frontoparietal control network during autobiographical planning is likely the result of not controlling for the perceptual features of the task (See Figure 7).

Supplemental Figure 5: Whole brain seed PLS results. AB Plan = autobiographical planning: Functionally connected regions with the default network during autobiographical planning. VS Plan = visuospatial planning: Functionally connected regions with the dorsal attention network during visuospatial planning. Outlined regions are the rsfcMRI maps. Blue = Default network, Red = Dorsal attention network, Green = Frontoparietal control network. Results are projected onto a flattened representation of the left and right cerebral hemispheres in Caret (Van Essen, 2005) and are thresholded at $p < .001$.

Supplemental Table 1: Peak regions of activation for Counting > Planning. Locations of the maxima are reported in the stereotaxic coordinates of MNI space.